Food and Agriculture Organization of the United Nations

SUSTAINABLE MANAGEMENT OF FORESTS IN MOUNTAIN AND VALLEY AREAS IN UZBEKISTAN

GCP/UZB/004/GFF

CONCEPT PROPOSAL FOR DEVELOPMENT OF NURSERIES IN UZBEKISTAN

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CONCEPT PROPOSAL FOR DEVELOPMENT OF NURSERIES IN UZBEKISTAN

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Content

Abbreviations

CPF	Country Programming Framework
FAO	Food and Agriculture Organization of the United Nations
FLR	Forest and Landscape Restoration
FO	Forestry Organization
GEF	Global Environmental Facility
Ha	Hectare
INDCs	Intended Nationally Determined Contributions
km	Kilometer
LDN	Land Degradation Neutrality
m	Meter
mm	Millimeter
m^2	Square meter
NWFPs	Non-Wood Forest Products
REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries; and the Role of Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks in Developing Countries
SCF	State Committee on Forestry
SDGs	Sustainable Development Goals
SFM	Sustainable Forest Management
SLM	Sustainable Land Management
UNCBD	The United Nations Convention on Biological Diversity
UNCCD	The United Nations Convention to Combat Desertification
UNFCCC	The United Nations Framework Convention on Climate Change
UNFF	The United Nations Forum on Forests
USD	United States Dollar

Executive Summary

Forest ecosystems in Uzbekistan represent great potential in terms of production of goods and services, which emphasized the importance for human well-being and the environment. Moreover, vast areas of land in Uzbekistan have little or no forest cover yet are suitable for forestry. If brought under sustainable forest management these areas could contribute to production of goods and services as well as local livelihoods and protection of nature. In addition to these lands, some of the existing forests are currently being degraded.

Sustainable forest management and rehabilitation/restoration of degraded forests could remove the barriers in Uzbekistan to reverse the current situation of degradation and help switch forestry onto a path of increased forest cover, increased social and economic benefits from forests, increased goods and services and an improved quality of existing forests.

Sustainable forest management practices and rehabilitation/restoration techniques for degraded forests require good quality planting materials. These planting materials can be produced in well-structured, organized, established and managed nurseries.

A nursery is a managed site that is established to produce good quality planting materials grown under special conditions and care to be used for planting for sustainable forest management practices, rehabilitation/restoration of degraded forests and horticulture.

Concept Proposal for Development of Nurseries in Uzbekistan was prepared under Food and Agriculture Organization of the United Nations (FAO)/Global Environmental Facility (GEF) funded Sustainable Management of Forests in Mountain and Valley Areas in Uzbekistan (GCP/UZB/004/GFF) project to provide guidance on the establishment and management of nurseries in Uzbekistan. The Concept Proposal will strengthen the understanding the purposes of nurseries, support the State Committee on Forestry by providing necessary information and defining the steps for fundamentals, technical planning considerations and investment costs for the establishment of nurseries.

The Concept Proposal targets nursery workers and nursery supervisors, forestry practitioners and policy and decision makers from the State Committee on Forestry and State Committee on Ecology and Environmental Protection. The Manual also targets the State and private nursery managers and administrators, horticulturists, seedling producers, natural resource managers and academicians from respective agencies.

The Concept Proposal consists of seven broad sections. Introduction section provides brief information about the importance and establishment purposes of nurseries and their role in global forest and other lands restoration needs, objectives, content and structure of the Concept Proposal including target groups. Section on Brief Information about the Project describes the project and presents the objectives of the project. Section on Brief

Information about the Project Pilot Sites defines the project pilot sites, namely, Pop, Sirdarya and Kitab. Section on State of Nurseries in Uzbekistan provides analyses and information on the current state of the nurseries. Main section of the Concept Proposal clearly set the roadmap for establishment and modernization of four selected nurseries in Uzbekistan. This includes fundamentals for selection of nursery sites, technical planning considerations and investment plans for all proposed nursery sites in Pop, Sirdarya and Kitab pilot sites. Section on Proposal for Upscaling at National Level describes the options for maintenance and upscaling the use of Concept Proposal at national level through establishing a nursery network. Finally, Work Plan section sets the required period for the establishment of nurseries, organization of trainings and monitoring and evaluation activities in Uzbekistan.

The Concept Proposal will be a supporting tool for the establishment and management of nurseries, which will target the production of plant materials for rehabilitation/restoration, sustainable forest management and horticulture (i.e. fruit and nut trees, medicinal plants) in Uzbekistan.

1. Introduction

Forest ecosystems in Uzbekistan represent great potential in terms of production of goods and services, which are important for human well-being and the conservation of environment. Moreover, vast areas of land in Uzbekistan have little or no forest cover yet are suitable for forestry. If brought under sustainable forest management (SFM) these areas could contribute to production of goods and services as well as local livelihoods and protection of nature. In addition to these lands, some of the existing forests are currently being degraded due to overgrazing, unsustainable use of resources, etc. Degraded forestlands should also be restored/rehabilitated to improve the production capacity of these resources and enhance the contributions to livelihoods and economy.

SFM, rehabilitation/restoration of degraded forests and horticulture practices could remove the barriers in Uzbekistan to reverse the current situation of degradation and help switch forestry onto a path of increased forest cover, increased social and economic benefits from forests including improved livelihoods, increased goods and services and an improved quality of existing forests.

SFM practices, rehabilitation/restoration techniques and horticulture practices require good quality planting materials. These planting materials can be produced in well-structured, organized, established and managed nurseries.

A nursery is a managed site that is established to produce good quality planting materials grown under specific conditions to be used for planting for SFM practices, rehabilitation/restoration of degraded forests and other lands and horticulture practices.

Nurseries play critical role in global efforts to combat climate change, forest degradation, land degradation, desertification and support forest and landscape restoration programmes. This is ensured by providing high-quality seedlings for restoration/rehabilitation of degraded forests and other lands, supporting forest management practices and establishment of new forest ecosystems and supplying seedlings for fruit and nut trees including medicinal and aromatic plants.

The recognition of the social, economic and ecological contributions of forest ecosystems and the global environmental benefits, which are provided through restoration/rehabilitation of degraded forests and other lands, and the ongoing international negotiations on climate change, land degradation, desertification and biodiversity conservation resulted in commitments by countries to restore/rehabilitate millions of hectares of deforested and degraded lands.

For example, 150 million hectares of deforested and degraded land around the world by 2020 and 350 million hectares by 2030 were targeted by using a landscape approach under Bonn Challenge. Reducing Emissions from Deforestation and Forest Degradation in Developing Countries; and the Role of Conservation, Sustainable Management of

Forests and Enhancement of Forest Carbon Stocks in Developing Countries (REDD+) aims to reduce emissions from deforestation and forest degradation in developing countries. Parties committed to promote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases not controlled by the Montreal Protocol, including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems under the United Nations Framework Convention on Climate Change (UNFCCC). Similar approach to stop forest loss and conserve forests and many more targets was also adopted through Intended Nationally Determined Contributions (INDCs) under Paris Agreement and global objectives on forests, United Nations Forest Instrument and United Nations Strategic Plan for Forests under United Nations Forum on Forests (UNFF). Finally, Sustainable Development Goals (SDGs) aim to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. Nurseries could help to meet these commitments through providing high-quality seedlings.

Nurseries can also serve as a seed bank, provide storage for species, establish and maintain demo plots, seed orchards, stooling beds, and other sources of propagative material. In addition to that, nurseries can be used as training centers and educational programs can be implemented in nurseries including extension services. Nurseries also provide enabling environment for research activities to improve the seedling production and harvesting techniques and seedling quality as well. Moreover, nurseries play a key role for improvement of livelihoods of people through providing employment to nursery workers (Haase and Davis, 2017).

Nurseries in Uzbekistan are old and mostly out of latest technology and produce seedlings under outdated techniques. These nurseries should be modernized and even new nurseries should be established for the planning and implementation of restoration/rehabilitation of degraded forests and other lands, support SFM, reforestation, erosion control activities and horticulture practices. Aforementioned activities require high-quality seedlings in order to achieve the expected goals.

The Concept Proposal for Development of Nurseries in Uzbekistan recognizes the importance of nurseries as an essential part of forestry activities. Therefore, the Concept Proposal is in line with project document, project implementation strategy, State Committee on Forestry (SCF) expectations and Concept for Restoration/Rehabilitation of Degraded Forests in Uzbekistan.

The Concept Proposal was prepared to provide guidance and coordination on the establishment and management of nurseries in Uzbekistan. The Concept Proposal will strengthen the understanding the purposes of nurseries, support the State Committee on Forestry by providing necessary information and defining the steps for fundamentals, technical planning considerations and investment costs for the establishment of nurseries.

The Concept Proposal provides detailed technical and financial information for the establishment of each proposed nursery area in selected pilot sites including area, availability of labor, water, and electricity, list of species, machinery, tools and equipment, estimated budget and work plan and other necessary criteria and indicators. A draft design and layout plan that demonstrates the location of facilities and seedling production areas was also provided within the Concept Proposal.

The Concept Proposal suggests two nurseries in Pop Forestry Organization (FO), one nursery in Sirdarya FO and one nursery in Kitab FO. Relevant technical indicators, which were explained in Section 5.1, were considered during the selection of nursery sites.

The establishment of proposed nurseries will provide high-quality seedlings for restoration/rehabilitation of degraded forests and other lands, reforestation, erosion control, prevention of soil loss; and for riverside plantation activities. Additionally, timber production will be supported by using seedlings of fast growing species. Timber would be used in construction, furniture and packing (pallet and box) sectors and other parts of the trees would be used as firewood and pallets for heating. Moreover, nurseries will produce seedlings of fruit and nut trees including medicinal and aromatic species and ornamental plants to support public and private sector demands. High-quality seedlings will play critical role to create healthy and resilient forest ecosystems and other landscapes. In the long-term, nurseries will serve to meet the objectives of SCF and contribute to livelihoods of local communities through employment and production of income generating species.

It should be noted that nurseries should be supported with trained and experienced staff, modern facilities and technologies, machinery, tools and equipment, assistance of stakeholders, cooperation between relevant agencies, law enforcement, and most importantly consistent and constant budget allocation and incentives for the sustainability purposes (Haase and Davis, 2017).

1.1. Objectives of the Concept Proposal

Concept Proposal for Development of Nurseries in Uzbekistan (the Manual herein after) was prepared to provide guidance on the establishment and management of nurseries in Uzbekistan.

The objectives of the Concept Proposals are to:

- Provide guidance on the establishment and management of nurseries in Uzbekistan,
- Strengthen the understanding of the importance and establishment purposes of nurseries and their role in global forest and other lands restoration/rehabilitation needs,
- Support the State Committee on Forestry by providing necessary information and defining the steps for fundamentals, technical planning considerations and investment

costs for the establishment and management of nurseries,

- Define training needs for key stakeholders (managers, technical staff, etc.) for capacity building and improved expertise,
- Describe the options for maintenance and upscaling the use of Concept Proposal at national level,
- Set timeline through a work plan for the establishment of nurseries in Uzbekistan.

The Concept Proposal will be a supporting tool for the establishment and management of nurseries, which will target the production of plant materials for rehabilitation/restoration, sustainable forest management and horticulture (i.e. fruit and nut trees, medicinal plants) in Uzbekistan.

1.2. Structure of the Concept Proposal (How to Use the Concept Proposal)

The Concept Proposal consists of seven broad sections. Introduction section provides brief information about the importance and establishment purposes of nurseries and their role in global forest and other lands restoration needs, objectives, content and structure of the Concept Proposal including target groups. Section on Brief Information about the Project describes the project and presents the objectives of the project. Section on Brief Information about the Project Pilot Sites defines the project pilot sites, namely, Kitab, Sirdarya and Pop. Section on State of Nurseries in Uzbekistan provides analyses and information on the current state of the nurseries. Main section of the Concept Proposal clearly set the roadmap for establishment and management of nurseries in Uzbekistan. This includes fundamentals for development and management of nurseries, technical planning considerations and investment plans for all pilot sites. Section on Proposal for Upscaling at National Level describes the options for maintenance and upscaling the use of Concept Proposal and national level. Finally, Work Plan section sets the required period for the establishment of nurseries in Uzbekistan.

1.3. Target Groups

The Concept Proposal targets nursery workers and nursery supervisors, forestry practitioners and policy and decision makers from the State Committee on Forestry and State Committee on Ecology and Environmental Protection. The Manual also targets the State and private nursery managers and administrators, horticulturists, seedling producers, natural resource managers and academicians from respective agencies.

2. Brief Information about the Project

The Republic of Uzbekistan is a Central Asian country with a total area of 447,400 km^2. The total area of forest according to FRA definition is 450.2 ± 81.8 thousand ha, about 1% of Uzbekistan's extent. The total area of Other Wooded Land is much larger (9230.4 ± 257.8 thousand ha, about 20.6 % of the country. According to SCF overall Forest Fund is estimated at approximately 9.75 million hectares, including 3 million ha covered with

forests. This amounts to approximately 6.8% of the country's area.

The Forest Law approved in 1999 provides the basis for forest management in Uzbekistan. According to the Forest Law, citizens have the right to access and harvest medicinal plants, food plants, berries and mushrooms for their own needs.

Forests of Uzbekistan are divided into the following categories: desert-like plains, valley-tugai (floodplains) forests and mountain area forests.

Mountain forests are found mostly on slopes of Western Tien Shan. Mountain vegetation has a zonal character and ranges from desert-like and dry steppes, through meadow steppes, bushes, deciduous and includes coniferous (juniper) forests, and ultimately subalpine and alpine meadows. The mountain forests can be classified by type such as juniper, pistachio, almond, walnut-tree, apple-tree, hawthorn, mixed forests, and shrubbery. The most important in terms of coverage area are juniper, pistachio and walnut.

Valley-tugai forests occur naturally on islands and in strips in the river floodplains. The total area in the country is estimated at 103,300 ha. The largest concentrations of tugai forests can be found in the delta of the Amudarya River in the Republic of Karakalpakstan, as well as along the Sirdarya River, in the lower reach of the Chirchik River, and along the Zerafshan River near to Samarkand. In addition, traditionally, stretches of planted windbreaks (mostly poplar) have played an important role in ecosystem protection, soil conservation and agriculture in valleys in Uzbekistan. These windbreaks have traditionally protected the high-value irrigated agricultural land near main rivers. The area of this productive and important land-use has shrunk in the past two decades from over 40,000 hectares to under 20,000 hectares. Moreover, timber (mostly poplar) could support the construction sector and packing of agricultural products.

The objective of the Sustainable Management of Forests in Mountain and Valley Areas in Uzbekistan (GCP/UZB/004/GFF) Project is to introduce sustainable forest management in Uzbekistan, thereby sequestering carbon and improving the delivery of ecosystem services and the quality of forest and tree resources. The barriers to sustainable forest management will be removed by implementation of four components:

- Component 1: Information management systems for sustainable forest management
- Component 2: Multifunctional forest management leading to carbon sequestration, an improvement in forest and tree resources, and other benefits
- Component 3: Upscaling of sustainable forest management – with carbon sequestration – by strengthening of the enabling environment
- Component 4: Monitoring, evaluation and knowledge sharing

The project demonstration areas are located both in mountain forests and in valley

forests. Based on the analysis of baseline investments and opportunities to influence both the institutional, legal and policy enabling conditions as well as management interventions on the ground, the following demonstration sites were selected:

- Sirdarya – shelterbelt plantations and tree nursery
- Dekhkanabad – high mountain plantation of Almond and Pistachio, mountain natural forest of Juniperus zeravshanica in combination with rangeland
- Kitab – Mountain natural forest with Juniper (Zarafshanica), tree nursery and plantation of Pistachio on mountain slopes using grove terracing system for water collection and erosion control
- Pop – plantation of medicinal and aromatic plants and pistachio in combination with agricultural crops on irrigated lands in otherwise very dry soils, tree nursery.

3. Brief Information about the Project Pilot Sites and Project Interventions[3]

3.1. Pop

The Forestry Organization (FO) manages 118,600 ha forest fund land of which only 15,000 ha are covered with forest. The natural forest is mainly juniper, which is found in the lower mountains. The upper mountain parts are mainly used for grazing. The FO, in the last years, supported about 20-30 ha of afforestation per year. The main species used for afforestation were poplar, pistachio and rosehip. The plantation activities of the FO so far have concentrated on land in the lower parts of the mountain slopes which have access to irrigation. The FO is specialized on the conservation and production of medicinal and aromatic plants.

Sustainable forestry management on 29,010 ha and improving the livelihoods of at least 100 farmers/households in Pop FO is the main output of the project. Project activities under this output will cover the development of forest management plans, forest restoration, rangeland/pasture management and livelihood improvement and community involvement.

Under forest restoration activities, establishment of nurseries are planned to produce high-quality planting materials to support project interventions on restoration/rehabilitation of degraded forestlands, support horticulture activities through fruit and nut trees and medicinal and aromatic plants, assist in implementation of SFM practices by FOs. Establishment of nurseries will be supported by several trainings on various topics such as seed and seedling production by focusing SCF staff and local farmers.

Under livelihood improvement and community involvement, nurseries will support the production and processing of planting materials including fruit and nut trees and

[3]Detailed information about the project interventions can be found in Concept for Restoration/Rehabilitation of Degraded Forests in Uzbekistan.

medicinal and aromatic plants with modern technologies and best techniques and practices and establishment of pistachio plantations. Production process will be supported by preparation of information materials such as manuals for production and processing of proposed and promoted planting materials including fruit and nut trees and medical and aromatic plants. Local farmers will also be supported by promoting and demonstrating effective mechanisms to establish their own profitable tree plantations and nurseries.

3.2. Sirdarya

The Forestry Organization (FO) manages 3,025 ha forest fund land. The Forestry Organization laments the lack of sufficient irrigation to cover all their lands and the salinization of some other parts of their lands. The region is suffering from strong winds during 7 months of the year, which leads to wind erosion and difficulties in pollination or drying out of croplands. Farmers are interested in establishing more shelterbelts on their farmland, since their positive effect on crop yields is clear.

Sustainable management of valley forests and shelterbelt forests on 2,995 ha in Sirdarya FO and improving the livelihoods of at least 100 farmers to establish shelterbelts on their land to protect crops and to generate other ecosystem services, such as sequestration of carbon is the main output of the project. Project activities under this output will cover the development of forest management plans, forest restoration and livelihood improvement and community involvement.

The plantation of tree shelterbelts does not only have a wind stopping function but also an ecological function. Especially in regions of intensive agricultural land use, it is important to have parts of the landscape serving ecological functions such as habitats for birds and insects and flowering vegetation. With these functions, the ecosystem will also be stabilized and a predatory bird population may better control insect or mouse infestations, and an insect populations living in these ecological belts will facilitate pollination of agricultural crops.

Under forest restoration activities, creation of the mother plantation of 5-8 hybrid poplars or alternative species of native origin with high productivity and rapid growth for the cuttings production, creation of a branch in the nursery for obtaining seedlings of these poplars from cuttings, cultivation of saplings of elm and ash and preparation of information materials about forest shelterbelts will be supported.

Under livelihood improvement and community involvement, nurseries will support the production of planting materials to establish shelterbelts. Local farmers will also be supported by awareness raising and training campaigns to encourage farmers to establish shelterbelts on their lands.

3.3. Kitab

The FO manages 54,000 ha of forest fund land of which 12,000 ha covered with forest. One-third of annual revenues are from the nursery operations, which mainly supplies seedlings for city greening including planting and tending services. The FO cooperates with the local population also on the establishment of afforestation areas with fruit and nut tree plantations and apple orchards. The FO also intends to introduce pine as a forest plantation species to be used for afforestation plots, as pines are expected to be productive and useful as construction wood. The FO would like the project to support the improvement of cooperation with the local population, which would include the establishment of a second nursery closer to the forestlands of the FO. Firewood is not a problem in this region, as the local population has woodlots to satisfy their needs for wood and timber.

Sustainable management of mountain forests on 16,200 ha and improving the livelihoods of at least 200 farmers/households in Kitab FO is the main output of the project. Project activities under this output will cover the development of forest management plans, forest restoration, rangeland/pasture management and livelihood improvement and community involvement.

Forest restoration will focus applying the watershed management approach as well as restoration of forests on the existing terraces, which were established by the FO. A mixed forest plantation approach can be used together with juniper forest, as this area is suitable for different type of tree species. It is also recommended to establish a regional training and extension centre for Mountain forestry development based in the Kitab FO as it is situated in the suitable area to demonstrate project achievement for other forestry organizations in the country dealing with mountain forestry development.

Relevant activities will include conducting trainings on the features of plant production, preparing information materials with recommendations for seedlings for various species, establishing a nursery for nursery operations cultivation of planting material with a closed root system (in plastic containers), seed collection, stratification, soil preparation and practical forest restoration measures.

Pistachio development and promoting firewood plantations with the involvement of local communities will also be the main activities in the FO. This applies to land that is currently used for food production and/or livestock grazing, but which is more suitable for sustainable forestry (pistachio or walnut orchards).

Under this output, a well-managed demonstration of productive and profitable forest plantation with fruit and nut bearing trees (mainly pistachio, almond, walnut) will be set up to encourage private entities to lease land from forest organizations to establish their own profitable tree plantations. It will be supported by the development of high-quality manuals, which describe the procedure of site selection, selection of appropriate

seedlings, planting techniques with description of watering and fertilization needs to ensure success and sufficient survival rates, treatment after planting to grow marketable products and harvesting techniques to ensure best quality of harvested products. The manuals will also include economic valuation of the plantations under various site conditions to allow private farmers to make an informed decision on entering into business related to tree planting. This is definitely needed, since farmers are expected to venture into a business that will bear fruit only after several years, depending on the type of trees they plant. The technical manuals will include:

- Site selection: Appropriate site conditions regarding soil, exposition, water regime and elevation have to be described to allow identification of appropriate sites for profitable management of the tree plantations
- Selection of appropriate seedlings: Here advice will be needed on the varieties of the trees to ensure productive and marketable varieties are selected. It will probably also be necessary to describe the techniques and treatments for most species to ensure high germination rates in the nurseries and the treatment of the small seedlings in the nursery.
- Planting techniques: Here it will be necessary to describe in detail how the trees should be best planted, from size and shape of the planting hole, size and shape of surface water collection measures (i.e. half-moon shaped small dams or groves along contour lines, which create a kind of terrace to collect surface water), with description of needed watering during the planting or short after and application of fertilizer to ensure success and sufficient survival rates.
- Treatment needed after planting needed to ensure tree and fruits to grow marketable products, such as pruning, fertilization and pollination or other measures need to be included in the manuals for each proposed and promoted tree species.
- Harvesting techniques need to be described when they are special, and different harvesting techniques can make a difference in the quality and yield of a tree plantation.

4. State of Nurseries in Uzbekistan

The Land Code (1998) classifies all land in Uzbekistan into eight categories, i.e.: forestlands, agricultural land, reserve land, private lands, industrial land, recreational lands, heritage and architectural lands and water bodies. It is important to note that there may be some forest cover or trees in any of these eight categories - both agricultural and reserve lands contain important areas of tree and forest cover.

The Forest Law approved in 1999 (and the amendments) provides the basis for forest management in Uzbekistan and specifies forestry functions, as well as specifying the competence of relevant public authorities and the types of forestry use, among others. While forests are state-owned, the 'use' of forestland can be transferred through constant or temporary leases. Notwithstanding, the vast majority of Forest Fund land is directly

managed by state agencies, notably SCF. Approximately 84% of Forest Fund is managed by the SCF, and the vast majority of this is managed by one of the 55 'Forest Organizations' that SCF had established across the country. In addition, according to the Forest Law, citizens have the right to access and harvest medicinal plants, food plants, berries and mushrooms for their own needs.

Forestlands are the property of the state. There is no private ownership of forests. The government is keenly committed to strengthen the forestry sector.

The main component of the National Forest Policy of the Republic of Uzbekistan is to develop strategies for sustainable forest management in the long term. Sustainable forest management in this context means not only continuous and sustainable management, but also a profitable management that ensures security, protection, regeneration of forest resources and biodiversity conservation.

Although efforts have been initiated for SFM, some forestland are facing degradation due to expansion of agricultural land and the increase in the livestock population. This has affected all forestland, notably desert and mountains, and has greatly reduced the possibility of natural succession or regeneration. Notably, this has greatly reduced the ability of forests to store and sequester carbon, and leads to loss of carbon in forest ecosystems.

Agricultural expansion is no longer a threat to remaining high quality forests. However, it does remain a barrier to the natural regeneration of forests and to the successful design and implementation of reforestation and afforestation schemes. The drivers of degradation, and the barriers to natural forest regeneration and to the successful implementation of reforestation and afforestation schemes, vary greatly from site to site and depend very much on the forest type. Notwithstanding, the forests in Uzbekistan face some common threats. It is important to note that these threats both continue to cause degradation and are a barrier to natural forest regeneration and to the successful implementation of reforestation and afforestation schemes. These common threats include:

- Livestock raising in and near to existing forests,
- The increasing demand for timber and wood-fuel,
- The unsustainable harvesting of non-wood forest products (NWFP),
- Pests and disease,
- Climate change.

The long-term solution is to ensure effective management of forestland and trees in production landscapes so that they can perform expected functions and continue to provide ecosystem services essential for people's livelihoods, local and national development and environmental sustainability.

Nurseries will play a key role to remove the barriers in Uzbekistan by providing planting materials for SFM, rehabilitation/restoration of degraded forests and other lands and improving livelihoods of local people through horticulture practices.
Currently, forest tree seedlings, fruit tree seedlings and limited number of medicinal and aromatic plants are grown in the nurseries of Uzbekistan based on the site conditions and demand from organizations and private farmers.

Nurseries may occupy vast areas in Uzbekistan. Therefore, poplar plantations are being established in the nurseries in addition to production of planting materials including grafted planting materials. Moreover, agricultural crops such as wheat, chickpea, grape, corn, etc. are also raised in forest nurseries. Fruit tree orchards are also established in nurseries to produce almond, apple, plum, cherry, walnut seedlings.

Plant production is done under outdated techniques and technologies. Some of the existing problems in nurseries are:

- Use of work force instead of mechanization in nursery operations,
- Lack of modern machinery, tools and equipment,
- Lack of adequate infrastructure, facilities and buildings,
- Lack of modern irrigation systems,
- Limited knowledge on modern seedling production techniques,
- Use of non-standard seedling beds,
- Low production number of qualified seedlings,
- Lack of container seedling production,
- Salinization in soil due to existing irrigation methodologies.

Some photographs are presented below to have clearer picture on the current state of nurseries in Uzbekistan.

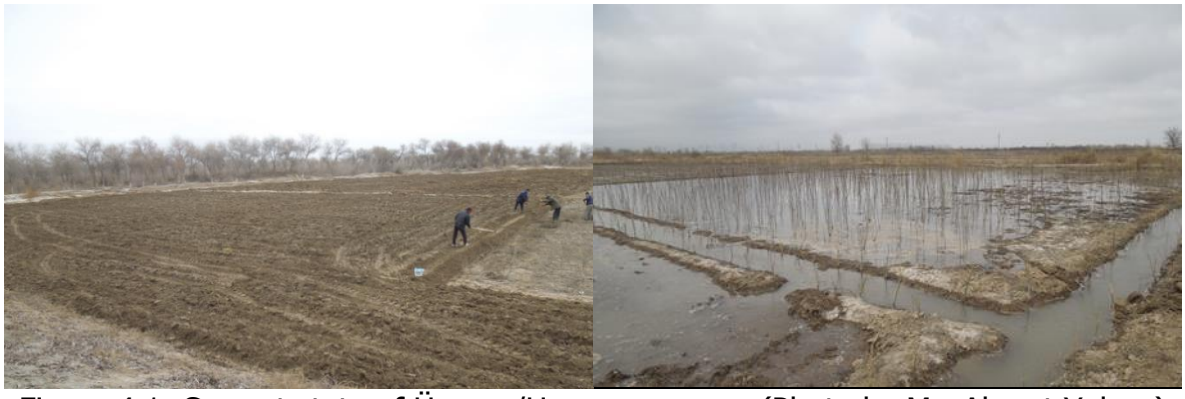

Figure 4.1. Current state of Ürgenç/Harezm nursery (Photo by Mr. Ahmet Yalvaç)

Figure 4.2. Current state of Elburuni/Nukus nursery (Photo by Mr. Ahmet Yalvaç)

Figure 4.3. Current state of Namangan nursery (Photo by Mr. Ahmet Yalvaç)

Figure 4.4. Current state of Namangan nursery (Photo by Mr. Ahmet Yalvaç)

Figure 4.5. Current state of Shirin nursery in Sirdarya (Photo by Dr. Caglar Bassullu)

Figure 4.6. Current state of Shirin nursery in Sirdarya (Photo by Dr. Caglar Bassullu)

Figure 4.7. Current state of Shirin nursery in Sirdarya (Photo by Dr. Caglar Bassullu)

Figure 4.8. Current state of Kitab nursery (Photo by Dr. Caglar Bassullu)

Figure 4.9. Current state of Kitab nursery (Photo by Dr. Caglar Bassullu)

Sustainable Management of Forests in Mountain and Valley Areas in Uzbekistan (GCP/UZB/004/GFF) project will support establishment and modernization of nurseries in Uzbekistan. The future support will include providing modern machinery, tools, equipment and capacity building activities (trainings, study tours, exchange of staff) on production of high-quality planting materials by experienced and training staff.

5. Concept Proposal for the Development of Nurseries in Pop, Sirdarya and Kitab

5.1. Fundamentals for Selection of Sites for the Development of Nurseries

Development of nurseries starts from the site selection that consist of several criteria or technical planning considerations including, but not limited to size of the catchment area, estimation of production needs, criteria for land selection (i.e. water, soil, electricity, local infrastructure), necessary space extend, machinery, equipment, tools and facilities, work force availability, maintenance, investment plan, etc.

Once the site is selected including design, layout and components of nursery, other detailed planning (physical establishment of nurseries from ground preparation to construction of facilities, etc.) and management (business plan, nursery development programme, records, maintenance, marketing, etc.), including seedling production programme (from seed collection to transportation of seedlings to field sites, etc.) issues should be taken into consideration. Here, the Concept Proposal addressed the technical planning considerations, estimated budget and possible species for production. Detailed planning, management and seedling production programme will be addressed in the next step.

Technical planning considerations to select possible areas for the development of nurseries are presented below.

- Type of the nursery
- Location (Site selection)
- Space availability and size
- Climate
- Soil
- Water supply for irrigation and water quality
- Electricity
- Availability of labor
- Shelter and fencing
- Topography and aspect
- Seedling demand and production types
- Ownership
- Accessibility
- Telecommunication
- Transport
- Infrastructure and facilities
- Machinery, tools and equipment

5.1.1. Type of the nursery

Nurseries can be developed either on permanent or temporary basis. While permanent nurseries serve for longer periods, temporary nurseries serve for a few seasons or years. Here, one temporary nursery was proposed in Pop and three permanent nurseries were proposed in Pop, Sirdarya and Kitab, respectively.

5.1.2. Location (Site selection)

Nurseries could be located close to plantation sites or close to populated areas, which are connected with main roads to reduce transportation costs of seedlings to field sites and accommodation costs of nursery workers. Moreover, administrative and operational matters in the nursery require input such as supply of materials, equipment, tools and

food as well. In addition to that, location of nursery sites should be carefully selected to avoid wind damage and flooding (Hall, 2003). Therefore, site selection would be the most important technical planning consideration.

5.1.3. Space availability and size

Main factors that influence the space availability and size of a nursery are the number of seedlings to be produced, the production types (production from seeds, grafts, bare-rooted cuttings or production in beds and in containers including the diameter of the containers) and water availability. In addition to that, additional space is needed for facilities, storage areas, and materials, manure, etc. (Dar, 2016).

Generally, seedling production areas (seedling beds, greenhouse, replacement beds, material areas, etc.) and facilities (offices, buildings, parking lot, etc.) are the main two sections of a nursery. Share of these two sections can be changed based on the production capacity and demand. Here, areas of selected nursery sites are presented in sections between 5.2-5.4 for each pilot site, and detailed work to specify the required areas for seedling production and facilities will be conducted in next step.

5.1.4. Climate

Nursery sites should have good climatic and environmental conditions to support seedling production. Nursery sites should not be too wet or too dry. Meteorological data on precipitation and temperature provide sufficient data on proposed nursery sites to check the availability of rainfall and temperature (Liegel and Venator, 1987).

5.1.5. Soil

Nursery site should provide suitable soil and relevant planting materials such as sand for seedling production. Particle size, organic matter content, nutrient content, soil porosity, moisture content and pH the main soil properties that provide information about the soil health and composition and this influence the quality of planting materials. Each property is interrelated and affects the plant growth (Hall, 2003; Dar, 2016). Nursery site should provide sufficient amount of good quality soil for the preparation of the container mixture and seedbeds. Otherwise, plant production could be supported by cattle manure, green manure, compost or forest soil to improve the nutrient content and soil structure. Container mixture may have sand to some extend if the soil is too heavy. In addition to organic soil to improve the nutrient content and local nursery soil, clay soil can also be used for physical structure for water infiltration (Dar, 2016).

Soil analyses will be conducted for all selected nursery sites during the next phase of technical planning considerations.

5.1.6. Water supply for irrigation and water quality

Nursery site should have permanent water supply such as river, spring, pond, and well, piped water system for irrigation throughout the year and minimum slope or system for drainage. Here, temporary nursery will have water supply through piped water system; permanent nursery in Pop will have water supply through river; permanent nursery in Sirdarya will have water supply through canal; and permanent nursery in Kitab will have water supply through artesian well.

It is advised also to store minimum three days water supply in relevant storage facilities (Hall, 2003).

Water quality is another important technical planning consideration. pH value should be between 5.5 and 7. Water analyses will be conducted for all selected nursery sites during the next phase of technical planning considerations.

5.1.7. Electricity

Nurseries must have permanent power (electricity) supply to support seedling production and use of necessary machinery, tools and equipment throughout the year. In addition to electricity network, generators in case of an electricity shortage should also support nurseries. Here, Sirdarya and Kitab nurseries have power supply for nursery operations. An electricity contract was signed for permanent nursery site in Pop and another contract will supposed to be signed for temporary nursery site.

5.1.8. Availability of labor

The nursery must be located where available work force can be employed. Nursery activities require intensive work force and the interactions between the nursery and work force availability affects the accommodation costs and other nursery costs. Here, available employees are living close to all selected sites.

5.1.9. Shelter and fencing

Nursery sites should be protected against wind and livestock with natural vegetation and/or manufactured structures. Here, nursery sites should be supported with natural vegetation and/or manufactured structures. Nurseries in Sirdarya and Kitab have trees on site that protect the sites from wind. All nursery sites needs fencing.

5.1.10. Topography and aspect

Nursery areas should be flat, sheltered and must have slight slope for drainage. Nursery area should be supported with a drainage system based on the site requirements (Hall, 2003).

Aspect is another important technical planning consideration. For example, during the summer time, sun light in the afternoon can cause seedling damage on the south aspect.

5.1.11. Seedling demand and production types

Seedling demand in terms of number of seedlings and production types (bare rooted or container seedlings), restoration/rehabilitation programmes and other forestry and horticulture activities are important factors for the selection of nursery sites. Here, two new nursery sites were selected in Pop to establish temporary and permanent nurseries, and existing nurseries will be maintained for modernization in Sirdarya and Kitab based on the above-mentioned technical planning considerations.

5.1.12. Ownership

Land ownership is an important technical planning consideration. The owner of the land should be clear. Here, all selected sites are belongs to forestry organizations under SCF.

5.1.13. Accessibility

Nursery sites must be easily accessible throughout the year. This will allow the transfer of seedlings to the field sites and markets and allow customers to come to nurseries to buy seedlings. Here, all selected nursery sites have good access roads.

5.1.14. Telecommunication

Nurseries must have good telecommunication channels such as telephone, internet, e-mail, radio, mobile phone, etc. for administrative, operational and marketing purposes. Here, all proposed sites have relevant communication channels to enable telecommunication.

5.1.15. Transport

Nurseries must have good access roads for fast delivery of planting materials to the required sites and ensure easy access of consumers to the nursery sites. Here, all selected sites have good access roads.

5.1.16. Infrastructure and facilities

Nurseries should have infrastructure and various facilities for administrative and operational reasons and based on the planting material demand. Each nursery may have water pool, material area, conifer replanting/transplantation area, bare-rooted seedling production area, container seedling production area, seed extraction area, seedling material area, deciduous replanting/transplantation area, greenhouse, manure area,

machinery and equipment parking lot, storage room, worker resting facility and WC, seed storage room, administration facilities, sheltered working area and main and side roads.

5.1.17. Machinery, tools and equipment

Nurseries must be supported with sufficient number of machinery, tools and equipment to conduct nursery operations. List of machinery, tools and equipment may slightly change based on the nursery objectives. Inventory of all items must be kept in the records. Moreover, all relevant items should be ready once the nursery is physically established and experienced staff must conduct periodic maintenance activities. Nursery must also have storage area and parking lot for machinery, tools and equipment.

Mr. Ahmet Yalvaç and Dr. Çağlar Başsüllü conducted a mission to field sites in Uzbekistan between 19 and 24 August 2019 to select possible sites for the development of nurseries. Based on the above-mentioned technical planning considerations, field observations and consultations with FAO and SCF staff, two nursery sites were selected in Pop, one nursery site was selected in Sirdarya and one nursery site was selected in Kitab. Following sections provide information on all technical planning considerations and investment plans for each proposed nursery site. Proposed nursery sites will be designed, planned and managed in terms of capacity and features based on the current and future needs of SFC, other organizations and individuals.

5.2. Technical Planning Considerations and Investment Plan for Pop

5.2.1. Temporary Nursery

A temporary nursery site was selected (Figure 5.1) in Oktepa region in order to provide planting materials to the restoration/rehabilitation of near degraded forests in mountain areas (Figure 5.2). Ownership of the land belongs to Pop FO. The selected site is flat with slight slope to allow drainage and close to restoration/rehabilitation areas. Pop FO also included these areas to its annual programme. Temporary nursery will be established in 1.5 ha. Additional area is available if any increase in production capacity is planned in future. A spring is located in 5km distance, and water for irrigation purposes and for the use during the seedling production process will be provided from this spring with pipes. Water tanks will be procured to store the water.

Coordinates of the temporary nursery is 41°02'06.7"N and 70°36'51.0"E and the location of the nursery is presented in Figure 5.3. Nursery site has access road, which needs to be stabilized or improved for transportation of planting materials.

Container seedlings will be produced in tunnel beds in the temporary with proposed species. Methodology to produce container seedlings will be seed sowing or seedling plantation in poly bags (Figure 5.4). Since the evaluation of the spring is higher than the proposed nursery site, watering will be done in connection with the water tanks through

sprinkler system.

Figure 5.1. Selected temporary nursery site in Oktepa region (Photo by Mr. Ahmet Yalvaç)

Figure 5.2. Restoration/rehabilitation areas in Oktepa region (Photo by Mr. Ahmet Yalvaç)

Figure 5.3. Location of selected temporary nursery site in Oktepa region (Photo by Mr. Ahmet Yalvaç)

Total planned seedling production capacity is 150,000 in 0.5 ha. Total seedling production capacity is estimated based on the assumption that, restoration/rehabilitation activities will take place in 150 ha annually and 1,000 seedlings will be planted per ha.

Figure 5.4. Example of container seedlings (Photo by Mr. Ahmet Yalvaç)

Soil and water analyses will be conducted once the Concept Proposal and budget availability are cleared and before the physical establishment of the nursery.

Electricity will not be needed in the nursery. However, Pop FO is searching for options to sign a contact with electricity provider for future nursery operations. Telecommunication is available.

Nursery site should be protected against wind and livestock with natural vegetation and/or manufactured structures. Temporary nursery site needs fencing.

Other detailed information with regard to proposed species, work force and required equipment and tools can be found in Table 5.5.

Estimated budget for the temporary nursery is USD 19,085. Detailed investment plan is given in Table 5.1.

Table 5.1. Investment Plan for Pop Temporary Nursery

No	Activity	Price
		USD
1	Office and Other Facilities	900
2	Seedling Production Areas and Irrigation Systems	10,000
3	Machinery, Tools and Equipment	0
4	Consumables	6,450
5	Stationery and Office Supplies	0
	Total Cost	17,350
	10% Unexpected Cost	1,735
	Grand Total	**19,085**

5.2.2. Permanent Nursery

A permanent nursery is a long-term commitment and investment. Therefore, special care and attention should be provided in developing the nursery (Liegel and Venator, 1987).

A permanent nursery site was selected (Figure 5.5) in Margouser region in Pop FO in order to provide planting materials for restoration/rehabilitation activities, SFM practices and horticulture activities.

Proposed site is suitable for nursery operations in terms of nursery techniques and technical planning considerations. Ownership of the land belongs to Pop FO. The selected site is flat with slight slope to allow drainage. Permanent nursery will be established in 6.5 ha (5.0 ha seedling production area and 1.5 ha roads and facilities). Additional area is available if any increase in production capacity is planned in future.

Proposed nursery site is close to Seyhun River and water for irrigation purposes and for the use during the seedling production process will be provided from the river with pipes. Water tanks will be procured to store the water.

Coordinates of the temporary nursery is 40°48'01.8"N 71°02'22.3"E and the location of the nursery is presented in Figure 5.6. Nursery site has access-paved road for transportation of planting materials and customers.

Figure 5.5. Selected permanent nursery site in Margouser region (Photo by Mr. Ahmet Yalvaç)

Figure 5.6. Location of selected permanent nursery site in Margouser region

Soil depth is good, but soil and water analyses will be conducted once the Concept Proposal and budget availability are cleared before the physical establishment of the nursery.

Electricity will be needed in the nursery. Power line is close to nursery site, around 200m. Pop FO is signed a contact with electricity provider for future nursery operations. Electricity will be available by end of 2019. Telecommunication is available.

Nursery site should be protected against wind and livestock with natural vegetation and/or manufactured structures. Nursery site needs fencing.

Available labor accommodate in Mirziaral Village, which has 2 km distance to proposed nursery site with easy access roads.

5.2.2.1. Seedling Production Area

Design and layout of a nursery would increase the efficiency of seedlings production and minimize the lost time for nursery staff and workers. Production types (bare-root or container seedlings), nursery techniques (mechanization), production capacity, number of species types, use of greenhouse, etc. defines the actual design and layout of a nursery (Liegel and Venator, 1987).

By considering these matters, nursery will be designed to have water pool, poplar material area, conifer replanting/transplantation area, bare-rooted seedling production area, container seedling production area, seed extraction area, seedling material area, deciduous replanting/transplantation, greenhouse, manure area, machinery and equipment parking lot, storage room, worker resting facility and WC, seed storage room, administration facilities, sheltered working area, roads and parking area (Figure 5.8).

Permanent nursery will be designed to produce high-quality planting materials as follows:

- Material garden will be established in 1.0 ha to produce seeds and cuttings for grafting in order to produce conifer and deciduous forest tree seedlings, ornamental planting materials and seedlings of income generating species.
- Poplar material garden will be established in 1.0 ha to produce poplar seedlings. Poplar seedlings will used by FO, private sector and farmers for establishment of poplar plantations.
- Replanting/transplantation area will be established in 1.0 ha for conifer and in 0.5 ha for deciduous seedlings. Total area will be 1.5 ha. Tall seedlings will be used for the plantation of roadsides, in parks and gardens by public institutions, private sector and farmers.
- Container conifer seedlings will be produced in 0.5 ha and container deciduous seedlings will be produced in 0.5 ha.
- 200m^2 greenhouse will be built with climate and irrigation system. Net area for seedling production will be 185m^2. 270 seedlings will be produced in 1m^2 by using viols, which carry 45 seedlings in each. Total number of seedlings will be around 50,000 (185x270=49.950).
- Water pool (10x10x2=200 tons) will be established to water all seedlings in the nursery.

Total seedling production capacity of the nursery will be 408,500 annually. In detail, 125,000 container deciduous seedlings, 150,000 container conifer seedlings, 12,500 deciduous replaced seedlings, 20,000 conifer replaced seedlings, and 50,000 poplar cuttings will be produced in open areas; and 50,000 seedlings will be produced in greenhouse. In addition to that, a material garden will be established by using 1000 high-quality seedlings from the region to be used as seedling production materials.

Nursery operations require various infrastructure and facilities. A closed/sheltered area will be built/designed to store the machinery, tools, equipment and other materials. A storage room will be built to store manure, containers, etc.; and sheltered facilities/area will be built for seed extraction, seed extraction machine, cold storage room for seeds and seedlings, materials for the container seedling production, area for container seedling production. Moreover, administration office for nursery staff, resting room for nursery workers and two separate WCs for men and women will be established.

5.2.2.2. Container Seedling Production in Sheltered/Closed Area

Seedlings in the viols, which will be produced in greenhouse, will be taken to poly bags with various diameters to produce container seedlings. A sheltered container seedling production area (4,200m^2) with irrigation system will be established to ensure that seedlings are easily adapted to outside conditions once they are taken from the greenhouse. (Figure 5.9). Poly bags will be placed to this sheltered area for 1 to 3 years. Preferably, 0.2m*0.3m sized poly bags will be used to produce 36 seedlings in 1m^2. In total, 144,000 seedlings will be produced in 4000m^2 of the sheltered area. 200m^2 of the area will be used for other purposes.

Sprinkler system will be used for watering and a system will be installed to provide manure during watering. Total production capacity of the sheltered area will be planned to be more than greenhouse.

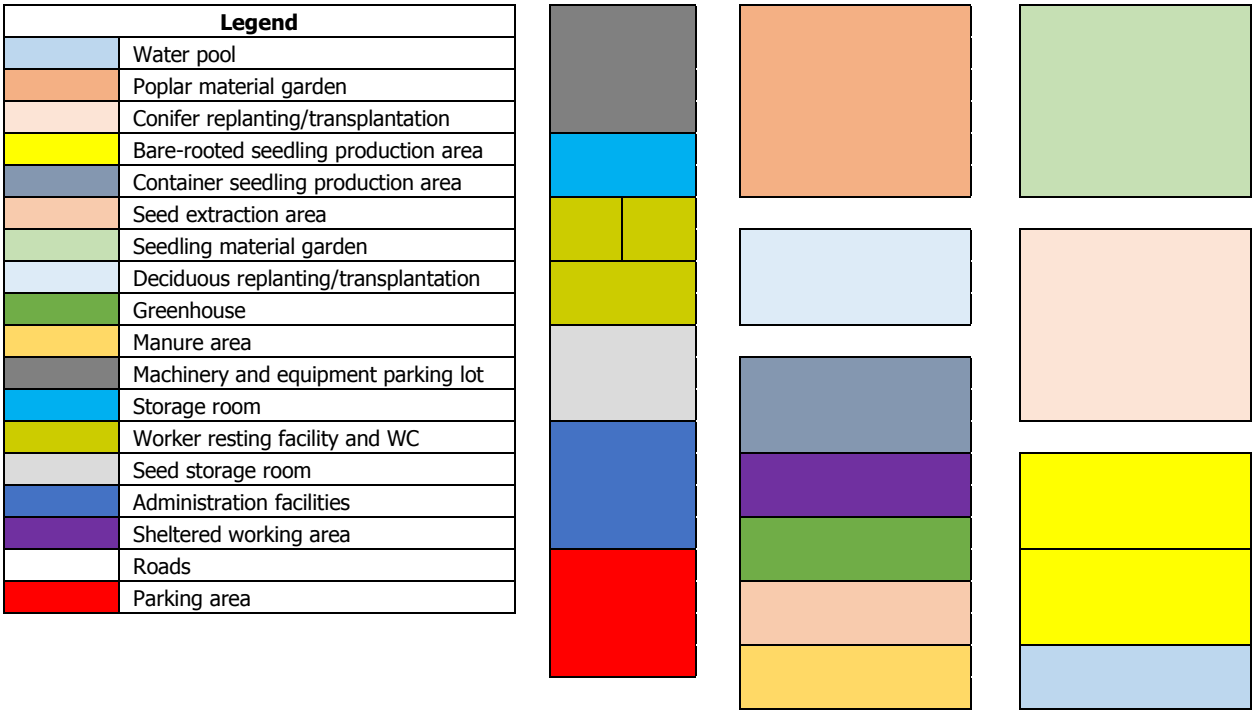

Figure 5.8. Design and layout of the permanent nursery

Figure 5.9. Sheltered area for container seedlings (Photo by Mr. Ahmet Yalvaç)

Other detailed information with regard to proposed species, work force and required equipment and tools can be found in Table 5.5.

Estimated budget for the permanent nursery is USD 326,788. Detailed investment plan is given in Table 5.2.

Table 5.2. Investment Plan for Pop Permanent Nursery

No	Activity	Price
		USD
1	Office and Other Facilities	47,000
2	Seedling Production Areas and Irrigation Systems	159,000
3	Machinery, Tools and Equipment	43,330
4	Consumables	39,050
5	Stationery and Office Supplies	8,700
	Total Cost	297,080.00
	10% Unexpected Cost	29,708.00
	Grand Total	**326,788.00**

5.3. Technical Planning Considerations and Investment Plan for Sirdarya

Existing nursery site in Shirin region was selected for modernization (Figure 4.5-4.7) in Sirdarya FO in order to provide planting materials for restoration/rehabilitation activities, SFM practices and horticulture activities.

Proposed site (Figure 5.10) is suitable for nursery operations in terms of nursery techniques and technical planning considerations. Ownership of the land belongs to Sirdarya FO. The selected site is flat with slight slope to allow drainage. Total area of the nursery is 16 ha. However, modernization will take place in 10.0 ha (5.0 ha seedling production area and 5.0 ha roads and facilities). Additional area is available if any increase in production capacity is planned in future.

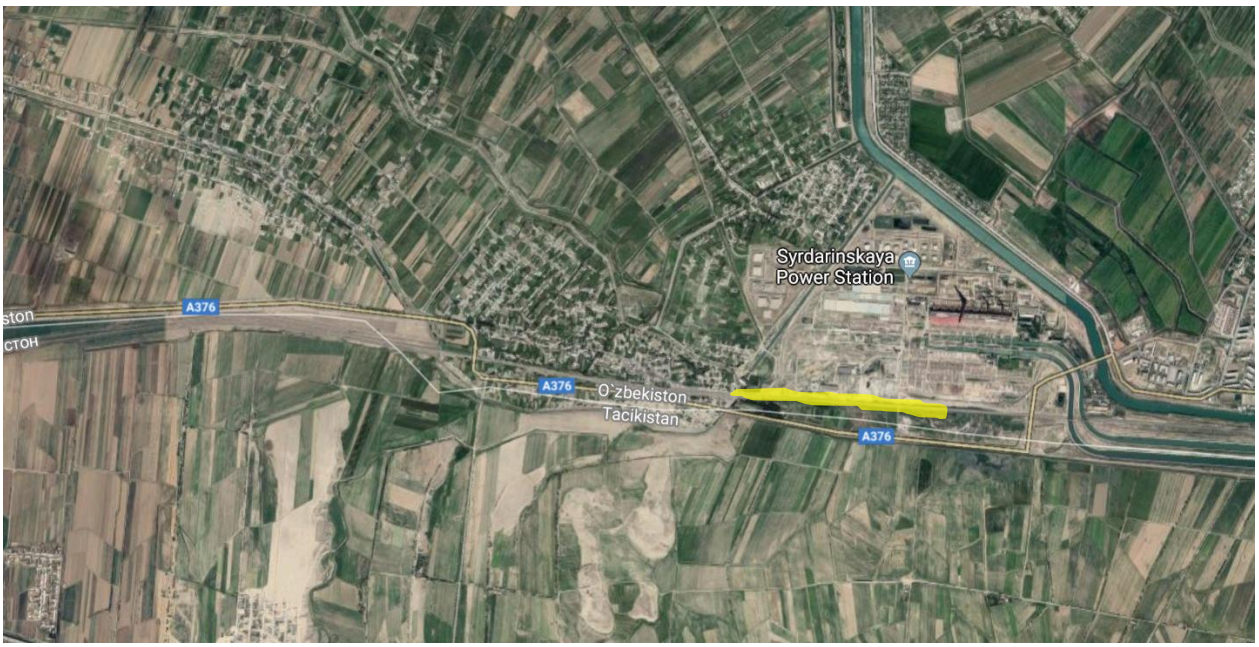

Figure 5.10. Location of selected permanent nursery site in Shirin region

Proposed nursery site is close to water canals. Water for irrigation purposes and for the

use during the seedling production process is providing from the artesian well. Water tanks will be procured to store the water.

Coordinates of the permanent nursery is 40°13'22.5"N 69°04'52.9"E and the location of the nursery is presented in Figure 5.6. Nursery site has access-paved road for transportation of planting materials and customers.

Soil depth is good, but soil and water analyses will be conducted once the Concept Proposal and budget availability are cleared before the physical establishment of the nursery.

Electricity is available in the nursery. Telecommunication is available. Nursery site should be protected against wind and livestock with natural vegetation and/or manufactured structures. Nursery site needs fencing.

Available labor accommodate in Old Shirin Village, to the proposed nursery site with easy access roads.

5.3.1.1. Seedling Production Area

Design and layout of a nursery would increase the efficiency of seedlings production and minimize the lost time for nursery staff and workers. Production types (bare-root or container seedlings), nursery techniques (mechanization), production capacity, number of species types, use of greenhouse, etc. defines the actual design and layout of a nursery (Liegel and Venator, 1987).

Shirin nursery is operational, however, several issues needs to be addressed. These issues are:

- Irrigation is done by using traditional flood irrigation method,
- Lack of planned rotational seedling production system,
- Species are separated in several locations
- Nursery operations are irregular,
- Limited machinery, tools and equipment,
- Lack of working and resting areas for staff and nursery workers,
- Lack of other facilities.

Hence, a decision was made to modernize the Shirin nursery to improve the conditions.

By considering these matters, nursery will be modernized to have water pool, poplar material area, conifer replanting/transplantation area, bare-rooted seedling production area, container seedling production area, seed extraction area, seedling material area, deciduous replanting/transplantation, greenhouse, manure area, machinery and equipment parking lot, storage room, worker resting facility and WC, seed storage room,

administration facilities, sheltered working area, roads and parking area (Figure 5.11).

Permanent nursery will be modernized to produce high-quality planting materials as follows:

- Material garden will be established in 1.0 ha to produce seeds and cuttings for grafting in order to produce conifer and deciduous forest tree seedlings, ornamental planting materials and seedlings of income generating species.
- Replanting/transplantation area will be established in 1.0 ha for conifer and in 1.0 ha for deciduous seedlings. Total area will be 2.0 ha. Tall seedlings will be used for the plantation of roadsides, in parks and gardens by public institutions, private sector and farmers.
- Container conifer seedlings will be produced in 1.0 ha and container deciduous seedlings will be produced in 1.0 ha.
- 200m^2 greenhouse will be built with climate and irrigation system. Net area for seedling production will be 185m^2. 270 seedlings will be produced in 1m^2 by using viols, which carry 45 seedlings in each. Total number of seedlings will be around 50,000 (185x270=49.950).
- Water pool (10x10x2=200 tons) will be established to water all seedlings in the nursery.

Total seedling production capacity of the nursery will be 655,000 annually. In detail, 250,000 container deciduous seedlings, 300,000 container conifer seedlings, 30,000 deciduous replaced seedlings and 25,000 conifer-replaced seedlings will be produced in open areas; and 50,000 seedlings will be produced in greenhouse. In addition to that, a material garden will be established by using 1000 high-quality seedlings from the region to be used as seedling production materials.

Nursery operations require various infrastructure and facilities. A closed/sheltered area will be built/designed to store the machinery, tools, equipment and other materials. A storage room will be built to store manure, containers, etc.; and sheltered facilities/area will be built for seed extraction, seed extraction machine, cold storage room for seeds and seedlings, materials for the container seedling production, area for container seedling production. Moreover, administration office for nursery staff, resting room for nursery workers and two separate WCs for men and women will be established.

5.3.1.2. Container Seedling Production in Sheltered/Closed Area

Seedlings in the viols, which will be produced in greenhouse, will be taken to poly bags with various diameters to produce container seedlings. A sheltered container seedling production area (4,200m^2) with irrigation system will be established to ensure that seedlings are easily adapted to outside conditions once they are taken from the greenhouse (Figure 5.9). Poly bags will be placed to this sheltered area for 1 to 3 years. Preferably, 0.2m*0.3m sized poly bags will be used to produce 36 seedlings in 1m^2. In

total, 144,000 seedlings will be produced in 4000m^2 of the sheltered area. 200m^2 of the area will be used for other purposes.

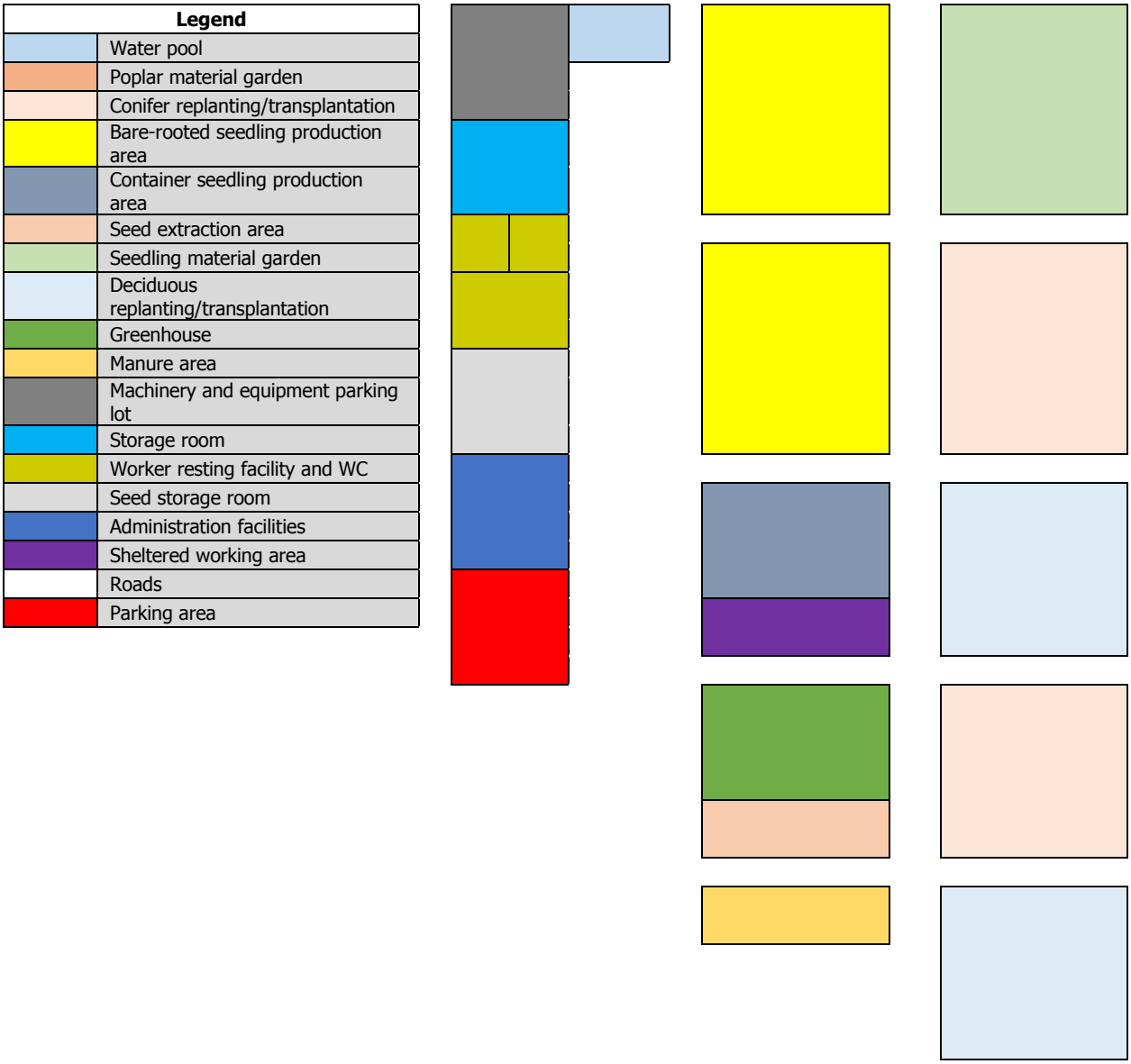

Figure 5.11. Design and layout of the permanent nursery

Sprinkler system will be used for watering and a system will be installed to provide manure during watering. Total production capacity of the sheltered area will be planned to be more than greenhouse.

Other detailed information with regard to proposed species, work force and required equipment and tools can be found in Table 5.5.

Estimated budget for the permanent nursery is USD 325,138. Detailed investment plan is given in Table 5.3.

Table 5.3. Investment Plan for Sirdarya Shirin Permanent Nursery

No	Activity	Price
		USD
1	Office and Other Facilities	45,500
2	Seedling Production Areas and Irrigation Systems	159,000
3	Machinery, Tools and Equipment	43,330
4	Consumables	39,050
5	Stationery and Office Supplies	8,700
	Total Cost	295,580.00
	10% Unexpected Cost	29,558.00
	Grand Total	**325,138.00**

5.4. Technical Planning Considerations and Investment Plan for Kitab

Existing nursery site in Kitab region was selected for modernization (Figure 4.8-4.9) in Kitab FO in order to provide planting materials for restoration/rehabilitation activities, SFM practices and horticulture activities.

Proposed site is suitable for nursery operations in terms of nursery techniques and technical planning considerations. Ownership of the land belongs to Kitab FO. The selected site is flat with slight slope to allow drainage. Total area of the nursery is 63 ha. However, modernization will take place in 39.0 ha. Additional area is available if any increase in production capacity is planned in future. Coordinates of the permanent nursery is 39°11'50.7"N 66°44'50.7"E and the location of the nursery is presented in Figure 5.12.

Figure 5.12. Location of selected permanent nursery site in Kitab region

Proposed nursery site is close to water canals. Water for irrigation purposes and for the use during the seedling production process is providing from the artesian well with the

support of water canals. Water tanks will be procured to store the water.

Nursery site has access-paved road for transportation of planting materials and customers.

Soil depth is good, but soil and water analyses will be conducted once the Concept Proposal and budget availability are cleared before the physical establishment of the nursery.

Electricity is available in the nursery. Telecommunication is available. Nursery site should be protected against wind and livestock with natural vegetation and/or manufactured structures. Nursery site needs fencing.

Available labor accommodate in close villages, to the proposed nursery site with easy access roads.

5.4.1.1. Seedling Production Area

Design and layout of a nursery would increase the efficiency of seedlings production and minimize the lost time for nursery staff and workers. Production types (bare-root or container seedlings), nursery techniques (mechanization), production capacity, number of species types, use of greenhouse, etc. defines the actual design and layout of a nursery (Liegel and Venator, 1987).

Kitab nursery is operational, however, several issues needs to be addressed. These issues are:

- Irrigation is done by using traditional flood irrigation method,
- Lack of planned rotational seedling production system,
- Lack of parcels,
- Species are separated and produced in several locations,
- Nursery operations are irregular,
- Limited machinery, tools and equipment,
- Lack of working and resting areas for staff and nursery workers,
- Lack of other facilities.

Hence, a decision was made to modernize the Kitab nursery to improve the conditions.

By considering these matters, nursery will be modernized in 39 ha to have water pool, poplar material area, conifer replanting/transplantation area, bare-rooted seedling production area, container seedling production area, seed extraction area, seedling material area, deciduous replanting/transplantation, greenhouse, manure area, machinery and equipment parking lot, storage room, worker resting facility and WC, seed storage room, administration facilities, sheltered working area, roads and parking area

(Figure 5.13).

Permanent nursery will be modernized to produce high-quality planting materials as follows:

- Material garden will be established in 2.0 ha to produce seeds and cuttings for grafting in order to produce conifer and deciduous forest tree seedlings, ornamental planting materials and seedlings of income generating species.
- Production of replaced seedlings have critical importance for the region. Therefore, replanting/transplantation area will be established in 9.0 ha for conifer and in 5.0 ha for deciduous seedlings. Total area will be 14.0 ha. At the initials stage, two parcels will be established and operational for conifer and deciduous seedlings. Other parcels should be established by SCF by using the project model. Replaced seedlings will be used for the plantation of roadsides, in parks and gardens by public institutions, private sector and farmers.
- Container conifer seedlings will be produced in 2.0 ha and container deciduous seedlings will be produced in 2.0 ha. Seedlings will be used to stop sand movement, restoration/rehabilitation of mountain areas, to produce replaced seedlings, and to avoid adverse effects of erosion in croplands. At the initials stage, two parcels will be established and operational for conifer and deciduous seedlings. Other parcels should be established by SCF by using the project model. Seedlings will also be used for the plantation of roadsides, in parks and gardens by public institutions, private sector and farmers.
- Around 25,000 ha area is suitable for poplar plantations. To meet the poplar seedling demand for plantation areas, poplar material garden will be established in 2.0 ha. These seedlings will be used for project interventions, and by private sector and local farmers to establish poplar plantations.
- 200m^2 greenhouse will be built with climate and irrigation system. Net area for seedling production will be 185m^2. 270 seedlings will be produced in 1m^2 by using viols, which carry 45 seedlings in each. Total number of seedlings will be around 50,000 (185x270=49.950).
- Water pool (10x10x2=200 tons) will be established to water all seedlings in the nursery.

Total seedling production capacity of the nursery will be 1,527,000 annually. In detail, 500,000 container deciduous seedlings, 600,000 container conifer seedlings, 150,000 deciduous replaced seedlings and 125,000 conifer-replaced seedlings, 100,000 poplar cuttings will be produced in open areas; and 50,000 seedlings will be produced in greenhouse. In addition to that, a material garden will be established by using 2000 high-quality seedlings from the region to be used as seedling production materials.

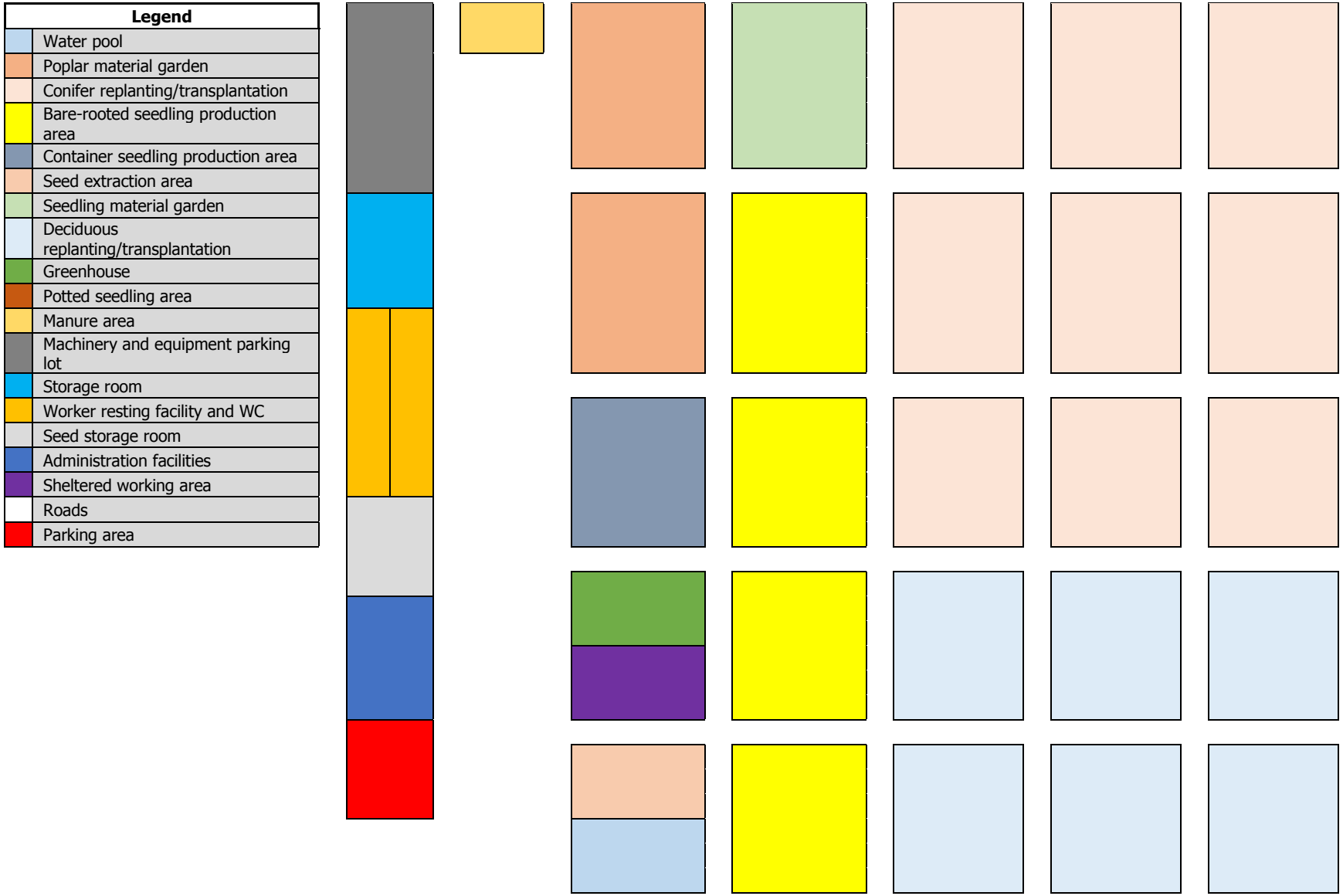

Figure 5.13. Design and layout of the permanent nursery

Nursery operations require various infrastructure and facilities. A closed/sheltered area will be built/designed to store the machinery, tools, equipment and other materials. A storage room will be built to store manure, containers, etc.; and sheltered facilities/area will be built for seed extraction, seed extraction machine, cold storage room for seeds and seedlings, materials for the container seedling production, area for container seedling production. Moreover, administration office for nursery staff, resting room for nursery workers and two separate WCs for men and women will be established.

5.4.1.2. Container Seedling Production in Sheltered/Closed Area

Seedlings in the viols, which will be produced in greenhouse, will be taken to poly bags with various diameters to produce container seedlings.

A sheltered container seedling production area (4,200m^2) with irrigation system will be established to ensure that seedlings are easily adapted to outside conditions once they are taken from the greenhouse (Figure 5.9). Poly bags will be placed to this sheltered area for 1 to 3 years. Preferably, 0.2m*0.3m sized poly bags will be used to produce 36 seedlings in 1m^2. In total, 144,000 seedlings will be produced in 4000m^2 of the sheltered area. 200m^2 of the area will be used for other purposes.

Sprinkler system will be used for watering and a system will be installed to provide manure during watering. Total production capacity of the sheltered area will be planned to be more than greenhouse.

Other detailed information with regard to proposed species, work force and required equipment and tools can be found in Table 5.5.

Estimated budget for the permanent nursery is USD 328,438. Detailed investment plan is given in Table 5.4.

Table 5.4. Investment Plan for Sirdarya Kitab Permanent Nursery

No	Activity	Price
		USD
1	Office and Other Facilities	48,500
2	Seedling Production Areas and Irrigation Systems	159,000
3	Machinery, Tools and Equipment	43,330
4	Consumables	39,050
5	Stationery and Office Supplies	8,700
	Total Cost	298,580.00
	10% Unexpected Cost	29,858.00
	Grand Total	**328,438.00**

Total estimated budget for establishment and modernization of the nurseries is USD 999,449 (Table 5.6).

5.5. Summary Tables for Selected Nursery Sites and Investment Plans

Table 5.5. Summary of selected nursery sites for Pop, Sirdarya and Kitab

No	Pilot Site	Proposed Species	Annual Total Production Capacity	Nursery Area	Work Force	Coordinates (UTM)	Basic Required Machinery, Tools and Equipment	Comments
1	Pop Forestry Organization (Oktepa)	*Juniperus seravschanica* *Pistacia vera* *Prunus bucharica* *Ulmus pumila* *Pinus nigra* *Juglans regia* *Prunus domestica* *Ziziphus zizyphus* *Elaeágnus angustifólia* *Rosa canina* *Berberis vulgaris* *Prunus armeniaca* *Prunus avium* *Malus domestica* *Celtis australis* *Juniperus semiglobosa* *Juniperus turkestanica* *Prunus amygdalus* *Prunus spinossissima* *Malus niedzwetzkvana* *Malus sieversi* *Malus kirghisorum* *Crataegus altaica* *Crataegus songarica* *Populus euphratica* *Populus diversifolia* *Populus pruinosa* *Populus Ariana* *Quercus spp.* *Acacia spp.* *Rosa kokanica*	150,000 seedlings	Catchment Area: 1.5 ha Nursery Area: 0.5 ha	6 staff 6 temporary workers	41°02'06.7"N 70°36'51.0"E	20 tons water tank 5km plastic pipe Sheltered irrigation system Containers (poly bags) Nylon packages Fencing Anchor Shoval Pickax Harrow Barrow Etc.	Temporary nursery
2	Pop Forestry Organization (Margouser Branch)	*Poplar spp.* *Ulmus pumila* *Frāxinus pennsylvānica* *Salix excelsa* *Elaeágnus angustifólia* *Juniperus seravschanica* *Celtis australis* *Ácer tatáricum* *Crataegus pontica* *Prunus bucharica* *Pyrus regelii* *Pistacia vera* *Rosa canina* *Morus spp.* *Juglans regia* *Pinus spp.* *Platanus orientalis* *Pyrus elaeagrifolia* *Ziziphus zizyphus* *Prunus domestica* *Berberis vulgaris* *Juniperus semiglobosa* *Juniperus turkestanica* *Prunus amygdalus* *Prunus spinossissima*	408,500 seedlings	Catchment Area: 6.5 ha Nursery Area: 6.5 ha	3 staff 20 temporary workers	40°48'01.8"N 71°02'22.3"E	Water tanks Plastic pipe Greenhouse with closed root system Moto cultivator Mini tractor Sheltered irrigation and filter system Drip irrigation system Irrigation pool Containers Fencing Well Water pomps Promotion sign Construction materials (cement, etc.) Plough Root cutting knife Saw Scissors Wringer Sieve Pulverization Nylon packages Tape meter GPS Fencing	Permanent nursery

		Malus niedzwetzkvana *Malus sieversi* *Malus kirghisorum* *Crataegus altaica* *Crataegus songarica* *Populus euphratica* *Populus diversifolia* *Populus pruinosa* *Populus Ariana* *Quercus spp.* *Acacia spp.* *Rosa kokanica*					Anchor Shovel Pickax Harrow Barrow Etc. Fertilizer Manure Mother seedlings Computer Fax and photocopy machine Camera Electrical tree branch cutting device Trailer Etc.	
3	Sirdarya Forestry Organization (Shirin Site)	*Poplar spp.* *Ulmus pumila* *Frāxinus pennsylvānica* *Salix excelsa* *Elaeágnus angustifólia* *Rosa canina* *Morus spp.* *Albizia julibrissin* *Prunus bucharica* *Salix spp.* *Fraxinus sogdiana* *Pinus spp.* *Juniperus seravschanica* *Prunus domestica* *Acer spp.* *Juglans regia* *Atriplex tatarica* *Atriplex hastate* *Climacoptera turcomanica* *Climacoptera ferganica* *Climacoptera lanata* *Platanus orientalis* *Thuja orientalis* *Juniperus semiglobosa* *Juniperus turkestanica* *Prunus amygdalus* *Prunus spinossissima* *Malus niedzwetzkvana* *Malus sieversi* *Malus kirghisorum* *Crataegus altaica* *Crataegus songarica* *Populus euphratica* *Populus diversifolia* *Populus pruinosa* *Populus Ariana* *Quercus spp.* *Acacia spp.* *Rosa kokanica* *Haloxylon arhyllum* *Haloxylon persicum* *Tamarix ramosisima* *Tamarix laxa* *Tamarix hispida*	655,000 seedlings	Catchment Area: 16 ha Nursery Area: 10 ha	15 permanent workers 15 temporary workers	40°13'22.5"N 69°04'52.9"E	Water tanks Plastic pipe Greenhouse with closed root system Moto cultivator Mini tractor Sheltered irrigation and filter system Drip irrigation system Irrigation pool Containers Fencing Well Water pomps Promotion sign Plough Root cutting knife Saw Scissors Wringer Sieve Pulverization Nylon packages Tape meter GPS Fencing Anchor Shovel Pickax Harrow Barrow Etc. Fertilizer Manure Mother seedlings Computer Fax and photocopy machine Camera Electrical tree branch cutting device Trailer Etc.	Permanent nursery

4	Kitab Forestry Organization	*Poplar spp.* *Ulmus pumila* *Frāxinus pennsylvānica* *Salix excelsa* *Elaeágnus angustifólia* *Juniperus seravschanica* *Celtis australis* *Ácer tatáricum* *Crataegus pontica* *Prunus bucharica* *Pyrus regeli* *Pistacia vera* *Rosa canina* *Morus spp.* *Juglans regia* *Berberis vulgaris* *Prunus domestica* *Malus domestica* *Punica granatum* *Prunus persica* *Prunus armeniaca* *Pyrus communis* *Ferula asafetida* *Juniperus semiglobosa* *Juniperus turkestanica* *Prunus amygdalus* *Prunus spinossissima* *Malus niedzwetzkvana* *Malus sieversi* *Malus kirghisorum* *Crataegus altaica* *Crataegus songarica* *Populus euphratica* *Populus diversifolia* *Populus pruinosa* *Populus Ariana* *Quercus spp.* *Acacia spp.* *Rosa kokanica*	1,527,000 seedlings	Catchment Area: 63 ha Nursery Area: 39 ha	10 permanent workers	39°11'50.7"N 66°44'50.7"E	Water tanks Plastic pipe Greenhouse with closed root system Moto cultivator Mini tractor Sheltered irrigation and filter system Drip irrigation system Irrigation pool Containers Fencing Well Water pomps Promotion sign Construction materials (cement, etc.) Plough Root cutting knife Saw Scissors Wringer Sieve Pulverization Nylon packages Tape meter GPS Fencing Anchor Shovel Pickax Harrow Barrow Etc. Fertilizer Manure Mother seedlings Computer Fax and photocopy machine Camera Electrical tree branch cutting device Trailer Etc.	Permanent nursery

Table 5.6. Summary of investment plans for Pop, Sirdarya and Kitab

No	Activity	Pop	Pop Temporary	Sirdarya	Kitab	Total
		USD	USD	USD	USD	USD
1	Office and Other Facilities	47,000	900	45,500	48,500	141,900
2	Seedling Production Areas and Irrigation Systems	159,000	10,000	159,000	159,000	487,000
3	Machinery, Tools and Equipment	43,330	0	43,330	43,330	129,990
4	Consumables	39,050	6,450	39,050	39,050	123,600
5	Stationery and Office Supplies	8,700	0	8,700	8,700	26,100
Total Cost		297,080	17,350	295,580	298,580	908,590
10% Unexpected Cost		29,708	1,735	29,558	29,858	90,859
Grand Total		**326,788**	**19,085**	**325,138**	**328,438**	**999,449**

6. Proposal for Upscaling at National Level

Uzbekistan has committed to forest and landscape restoration/rehabilitation (FLR), decreasing forest and land degradation, enhancement of forest stocks, combating with desertification and climate change through ambitious pledges in numbers of hectares to be restored/rehabilitated, reforested and sustainably managed.

These commitments were submitted globally under the UNFCCC through Paris Agreement and its INDCs for adaptation of ecosystems (GoU, 2017) including measures on afforestation, forest restoration and plantation (GoU, 2016); under the United Nations Convention on Biological Diversity (UNCBD) for conservation, restoration and sustainable management and use of biodiversity, ecosystems and ecosystem services (GoU, 2018); under the United Nations Convention to Combat Desertification (UNCCD) by developing the Land Degradation Neutrality (LDN) target-setting programme for restoration of degraded ecosystems (GoU, 2019); and under FAO strategic objectives to increase and improve provision of goods and services from agriculture, forestry and fisheries in a sustainable manner; under FAO regional priority 3 for natural resource management, including climate change mitigation and adaptation; and under FAO Country Programming Framework (CPF) to strengthen national capacity for sustainable management of natural resources, climate change and biodiversity between 2018 and 2022 (CPF, 2017).

The Concept Proposal will support the implementation of national strategies, programmes and action plans under the UNFCCC, UNCCD and UNCBD.

As the implementation of these commitments happens, different actors from national to local scales must develop and negotiate the "what, where, when and how" of specific forest and other land restoration/rehabilitation plans and SFM/Sustainable Land Management (SLM) strategies.

Implementation and upscaling of national activities to support the global efforts on FLR, decreasing forest and land degradation, enhancement of forest stocks, combating with desertification and climate change require an 'order-of-magnitude' increase in the provision of high-quality planting material through establishment of modern nursery network in Uzbekistan.

The Concept Proposal will support the GCP/UZB/004/GFF project to deliver global environmental benefits related to climate change mitigation, reversal of land degradation processes and SFM.

The current capacity of nurseries is insufficient to meet the national scale future demand, and it is essential that the necessary increase in nursery production does not trade quantity for quality of plant material.

The Current Concept Proposal is providing clear guidelines, necessary information and defining the steps for fundamentals, technical planning considerations and investment costs for the establishment of nurseries. Based on Pop, Sirdarya and Kitab examples, it will be possible to upscale and develop nurseries network at national level, through the roadmap for establishment and management of nurseries in Uzbekistan. Nurseries network will have same management plans, financial plans, capacity building approach and environmental goals with different technical planning consideration and species adopted for each region.

Different stakeholders and decision makers at national, regional and local scales shall be interviewed to receive their feedback regarding the barriers and strategies for upscaling the development of nurseries in Uzbekistan. Therefore, the Concept Proposal provides a road map on technical planning considerations and investment plans establishing the nursery network in the country and in other countries where similar conditions exist.

The Concept Proposal considers various characteristics of the pilot sites. These are, for example, topography, climate, soil, water resources, vegetation cover, species types, seed and seedling demand. Therefore, future nurseries will have different features in terms of type, production capacity, etc. These examples can be mainstreamed and upscaled to similar regions, which have similar characteristics in Uzbekistan to establish modern nursery network in the country.

The Concept Proposal suggest modern nurseries with high technology facilities, machinery, equipment, tools and best seed and seedling production practices. Therefore, successful, standard, planned, sufficient and sustainable high-quality seed and seedling production will be ensured throughout the year in modern nurseries by leaving outdated conditions and practices, which will result in high survival rate of seedlings and success in SFM practices, reforestation and restoration/rehabilitation areas at national level. New technologies and techniques will support the upscaling of high-quality seed and seedling production and development of nursery sector across the country. If possible, regional demand on seeds and seedlings would also be guaranteed from these modern nurseries.

The Concept Proposal suggest producing high-quality planting materials to improve the livelihoods of local farmers. This will be ensured by production of income generating species including fruit and nut trees and medicinal and aromatic species. The nurseries will support the local farmers by providing seedlings to establish gardens of fruit and nut trees including medicinal and aromatic plants.

Timber production will be supported by breeding and using seedlings of fast growing species, especially poplar species. Timber would be used in construction, furniture and packing (pallet and box) sectors and other parts of the trees would be used as firewood and pallets for heating. Poplar production would also support the cellulose demand at national level. Nurseries will support farmers to establish poplar plantations throughout the country to supply wood demand. Poplar plantations will result in establishment of

small family wood processing business and facilities, which will support national economy.

Production of various types of seeds and seedlings in modern nurseries will support the biodiversity conservation and expand habitats for biodiversity in the mountain and valley forests of Uzbekistan.

Nurseries will produce seeds and seedlings to establish shelterbelts around the agricultural areas to reduce the adverse effects of erosion, support crop production in terms on food safety, and stabilize the soil loss through river and channel sides.

Nurseries will create enabling environment for employment of local people, especially women to empower women participation in nursery activities and this will lead the improvement of livelihood and creation of new jobs and increased opportunities for income generation throughout the country.

Nurseries will create enabling environment for development of new green ideas from local level to global level through playing a role in urban and rural development including supporting the sustainable use of all land use types.

Nurseries will support the demand of future local, national and regional sustainable resource management projects.

Nurseries will also serve as training centres, knowledge and information sharing platforms and demonstration sites at local, national and regional level by including neighbouring countries, seedling producers and farmers.

Nurseries will improve communication on objectives and environmental, social and economic benefits of nurseries; support Uzbekistan participation in global initiatives and platforms and improve rural extension support (Bull et al., 2018; Strassburg et al., 2018; Stanturf et al., 2019).

Modern nurseries require experienced and trained staff with updated organizational capacity. Therefore, proposed nurseries may lead to improve governance arrangements and political environment through participatory planning approach (Bull et al., 2018; Strassburg et al., 2018; Stanturf et al., 2019).

Modern nurseries with high-quality planting materials may lead the establishment of certification system for the production of certified seeds and seedlings.

Investment costs for the development of nurseries will provide a perspective to find adequate funding sources involving international, national and private stakeholders and institutions to overcome the financial barriers (Bull et al., 2018; Strassburg et al., 2018; Stanturf et al., 2019).

Mainstreaming and upscaling the use of the Concept Proposal will be ensured by capacity building events such as trainings, study tours, to improve the capacities of all stakeholders. Moreover, trainings on new technologies and new techniques on seedling production will also enhance the knowledge on producing high-quality seedlings for various forestry activities.

Model nursery practices and various forestry activities in the field will raise awareness amongst policy and decision-makers and local stakeholders for enhancing the critical role of forest ecosystems and forestry sector in Uzbekistan for the nature conservation.

Monitoring and evaluation activities in nurseries will assist nursery managers to focus on the gaps and find options/solutions to improve the conditions in nurseries to upscale the best practices in Uzbekistan.

Moreover, robust monitoring and evaluation system for the quality of seeds and seedlings and their success in forestry activities and management interventions will provide a basis to improve the quality of production process, remove barriers, and cost efficiency estimations (Stanturf et al., 2019) for the use of new technologies and techniques could reduce the total expenditures and future planning considerations.

Finally, the Concept Proposal will be a supporting tool for the establishment and management of nurseries, which is targeting the production of plant materials for rehabilitation/restoration, SFM and horticulture (i.e. fruit and nut trees, medicinal plants) in Uzbekistan.

7. Workplan

Activity	2019		2020				2021				2022			
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Preparation of Concept Proposal for Development of Nurseries in Uzbekistan														
Selection of nursery sites and species														
Determination of needs of nurseries (facility, machinery, tool, equipment, etc.)														
Preparation of nursery projects for each nursery														
Tender process for machinery, equipment and tools														
Establishment of nurseries														
Training on nursery projects-management and planning (i.e. from ground preparation to transportation of seedlings to field sites)														
Planning of seedling production programme														
Seedling production														
Training on introduction of new seedling production techniques including new species varieties														
Trainings on poplar seedling production														
Trainings on other seedlings production														
Awareness raising trainings on poplar for farmers														
Awareness raising trainings on gender equality														
Awareness raising trainings on conservation and re-production of some IUCN red list species (i.e. Populus pruinosa)														
Awareness raising trainings on plant watering techniques and technologies for farmers														
Capacity building trainings on seed collection, seed storage, seed preparation, ground preparation, seed sowing, container seedling production, germination, watering techniques, maintenance, use of machinery and equipment, pest and disease control, nursery infrastructure, and cuttings in seed and transplanting beds														
Trainings on principles of creating permanent forest seed stands, seed gardens and seed orchards														
Trainings on crop rotations in nurseries, irrigation regimes, use of mineral and organic fertilizers														
Study tours														
Preparation of PR materials (brochures and videos) and extension services														
Monitoring and Evaluation														

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